

CLAIMS

- [1] A plasma processing apparatus comprising a shower plate having a plurality of ejection holes for ejecting a gas, a microwave antenna, and a cover plate interposed between said shower plate and said microwave antenna, said plasma processing apparatus being characterized in that said cover plate is formed by a material which has a relative dielectric constant smaller than that of a material of said shower plate.
- [2] A plasma processing apparatus according to claim 1, characterized in that the material of said cover plate is smaller in the relative dielectric constant and is larger in thermal conductivity as compared with the material of said shower plate.
- [3] A plasma processing apparatus according to claim 2, characterized in that the material of said cover plate is smaller in the the relative dielectric constant and larger in the thermal conductivity as compared with the material of said shower plate and further has a dielectric loss of 1×10^{-3} or less in microwave.
- [4] A plasma processing apparatus according to claim 1, characterized in that the material of said cover plate contains at least one of silicon nitride and quartz and the material of said shower plate contains alumina.
- [5] A plasma processing apparatus comprising a shower plate having a plurality of ejection holes for ejecting a gas, a microwave antenna, and a cover plate interposed between said shower plate and said microwave antenna, said plasma processing apparatus characterized in that one of main surfaces of said cover plate comprises a plurality of projection-like portions contacted with said shower plate at portions at which no ejection holes are present on one of main surfaces of said shower plate and said projection-like portions are each formed by obtuse angles or a curved line when said one of main surfaces of said cover plate is seen from the above.

[6] A plasma processing apparatus according to claim 5, characterized in that said projection-like portions each form a circle when said one of main surfaces of said cover plate is seen from the above.

[7] A plasma processing apparatus comprising a shower plate having a plurality of ejection holes for ejecting a gas, a microwave antenna, and a cover plate interposed between said shower plate and said microwave antenna, said plasma processing apparatus characterized in that one of main surfaces of said cover plate comprises connected projection-like portions contacted with said shower plate at which no ejection holes are present on one of main surfaces of said shower plate and hollow-like portions other than said projection-like portions, and said hollow-like portions include a curved line portion connected to upper portions of said ejection holes at said one of main surfaces of said shower plate and a gas introducing portion for introducing the gas into said curved line portion.

[8] A plasma processing apparatus according to claim 7, characterized in that said curved line portion of said hollow-like portions includes a plurality of ring-shaped portions forming concentric circles and said gas introducing portion of said hollow-like portions includes a linear portion connecting said ring-shaped portions.

[9] A plasma processing apparatus comprising a shower plate having a plurality of ejection holes for ejecting a gas, a microwave antenna, and a cover plate interposed between said shower plate and said microwave antenna, said plasma processing apparatus characterized by including a structure wherein one of main surfaces of said cover plate comprises at least one projection-like portion contacted with said shower plate at portions at which no ejection holes are present on one of main surfaces of said shower plate and a gas distribution portion that is not contacted with said portions and that forms a gas distribution space between itself and said one of main surfaces of said shower plate, and

means for introducing the gas to said one of main surfaces of said shower plate in order to cause the gas to flow into said ejection holes of said shower plate introduces the gas to said gas distribution portion at said one of main surfaces of said cover plate from its peripheral portion.

[10] A plasma processing method characterized by carrying out plasma processing using the plasma processing apparatus according to any one of claims 1 to 9.

[11] A product manufacturing method characterized by carrying out plasma processing using the plasma processing apparatus according to any one of claims 1 to 9, thereby manufacturing a product.

[12] A product manufacturing method according to claim 11, characterized in that said product is a semiconductor device.

[13] A product manufacturing method according to claim 11, characterized in that said product is a liquid crystal display device or an organic EL display device.